

WHAT IS CLAIMED IS:

Claim 1:

1 1. A database search method for performing a B or B+ Tree search responsive  
2 to a user query wherein said user query has a range for a first key value and a  
3 definite second key value specified in said user query, said method comprising:

4 a) automatically selecting a one of two search methods wherein a first  
5 method of said two search methods is a next sequential leaf fetch and a  
6 second method is a trapeze fetch search method, said automatic selection  
7 being accomplished without any direct or indirect directing input from said  
8 user query,

9 b) executing said selected search method to fetch a next leaf page  
10 containing records,

11 c) searching every record in a fetched next leaf page even after a current  
12 value for said first and second keys may have become exhausted during  
13 the searching of every record, prior to completing said searching of every  
14 record,

15 d) returning records from said fetched next leaf page and if said query is  
16 satisfied, ending said method.

Claim 2:

1 2. The database search method of Claim 1 wherein if said query is not satisfied  
2 in step (d), returning to step (a), wherein said selection method of step (a) further  
3 comprises,

4 examining a last record from said fetched next leaf page from a last  
5 previously performed step (c) and if said last record has a first key value in said first  
6 key value range and said definite key value, then selecting said first search method,  
7 else selecting said second search method.

**Claim 3:**

1 3. The database search method of Claim 1 wherein if said query is not satisfied  
2 in step (d), returning to step (a), wherein said selection method of step (a) further  
3 comprises,

4 examining a last record from said fetched next leaf page from a last  
5 previously performed step (c) and if said last record has a first key value in said first  
6 key value range and said definite key value, then selecting said first (next sequential  
7 leaf fetch) search method, else selecting said second (trapeze fetch) search method  
8 and said step (a) still further comprises;

9 for each selection of said first method and said second method, changing a  
10 value in an operations record of selections made.

**Claim 4:**

1 4. The database search method of Claim 3 wherein if a value of said operations  
2 record of selections made is a predetermined first value, disabling said database  
3 search method's ability to select said second (trapeze fetch) search method until  
4 said value of said operations record of selections made is modified to a  
5 predetermined second value, and then re-enabling selectability of said second  
6 (trapeze fetch) search method.

**Claim 5:**

1 5. The database search method of Claim 4 wherein changes in said value of  
2 said operations record of selections is used to produce data indicating how many  
3 times said second search method is used in a query.

**Claim 6:**

6. The database search method of Claim 1 wherein if said query is not satisfied in step (d), returning to step (a), wherein said selection method of step (a) further comprises,

examining a last record from said fetched next leaf page from a last previously performed step (c) and if said last record has a first key value in said first key value range and said definite key value, then selecting said first (next sequential leaf fetch) search method, else selecting said second (trapeze fetch) search method and said step (a) still further comprises;

for each selection of said first method changing a first value in a first operations record of selections made and for each selection of said second method, changing a second value in a second operations record of selections made.

**Claim 7:**

7. The database search method of Claim 6 wherein if a value of said first operations record of selection made is a predetermined first value, disabling said database search method's ability to select said second (trapeze fetch) search method unless said value of said second operations made is modified to a predetermined second value, and then re-enabling selectability of said second (trapeze fetch) search method.

**Claim 8:**

8. The database search method of Claim 7 wherein changes in said first and second values of said first and second operations record of selections is used to produce data indicating how many times said second search method is used in a query.

**Claim 9:**

1 9. The database search method of Claim 1 wherein each selection of said  
2 second (trapeze fetch) method is recorded and used as a basis for reporting a  
3 number of times sequential leaf pages have been skipped in satisfying a query.

**Claim 10:**

1 10. A database search method for performing a B or B+ Tree search responsive  
2 to a user query wherein said user query has a range for a first key value and a  
3 definite second key value specified in said user query, said method comprising:

4 a) automatically selecting a one of two search methods wherein a first  
5 method of said two search methods is a next sequential leaf fetch and a second  
6 method is a trapeze fetch search method, said automatic selection being  
7 accomplished without any direct or indirect directing input from said user query  
8 wherein said selection method of step further comprises,

9 1) examining a last record from a last previously fetched next leaf page,  
10 or from a first fetched leaf page if this step (1) is being performed a first  
11 time in response to said user query, and if said last record has a first key  
12 value in said first key value range and said definite key value, then  
13 selecting said first search method, else selecting said second search  
14 method,

15 2) for each selection of said first method changing a first value in a first  
16 operations record of selections made and for each selection of said  
17 second method, changing a second value in a second operations record  
18 of selections made,

19 b) executing said selected search method to fetch a next leaf page  
20 containing records,

21 c) serially searching records in a fetched next leaf page until a current  
22 value for said first and second keys may have become exhausted during the  
23 searching of every record,

24 d) returning records from said fetched next leaf page and if said query is  
25 satisfied, ending said method, else performing steps (a)-(d), iteratively until said  
26 query is satisfied.

**Claim 11:**

1 11. The database search method of Claim 10 wherein each selection of said  
2 second (trapeze fetch) method is used as a basis for reporting a number of times  
3 sequential leaf pages have been skipped in satisfying a query.

**Claim 12:**

1 12. A database search method for performing a B or B+ Tree search responsive  
2 to a user query wherein said user query has a range for a first key value and a  
3 definite second key value specified in said user query, said method comprising:

4 a) automatically selecting a one of two search methods wherein a first  
5 method of said two search methods is a next sequential leaf fetch and a second  
6 method is a trapeze fetch search method, said automatic selection being  
7 accomplished without any direct or indirect directing input from said user query  
8 wherein said selection method of step further comprises,

9 1) examining a last record from a last previously fetched next leaf page,  
10 or from a first fetched leaf page if this step (1) is being performed a first  
11 time in response to said user query, and if said last record has a first key  
12 value in said first key value range and said definite key value, then  
13 selecting said first search method, else selecting said second search  
14 method,

15 2) for each selection of said first method and said second method,  
16 changing a value in an operations record of selections made,

17 b) executing said selected search method to fetch a next leaf page  
18 containing records,

19 c) serially searching record in a fetched next leaf page until a current  
20 value for said first and second keys may have become exhausted during the  
21 searching of every record,

22 d) returning records from said fetched next leaf page and if said query is  
23 satisfied, ending said method, else performing steps (a)-(d), iteratively until said  
24 query is satisfied.

**Claim 13:**

1 13. The database search method of Claim 10 wherein each selection of said  
2 second (trapeze fetch) method is used as a basis for reporting a number of times  
3 sequential leaf pages have been skipped in satisfying a query.

**Claim 14:**

1 14. The database search method of Claim 10 wherein each selection of said first  
2 method is used to reevaluate a turn-off-swinging value, and if said turn-off-swinging  
3 value reaches a high predetermined turn-off-swinging value level, altering step (a) so  
4 that only said first method is selected, unless and until said turn-off-swinging value  
5 reaches a low predetermined turn-off-swinging value, and in such event, reverting to  
6 said original form of step (a).

**Claim 15:**

1 15. A search method program for performing a B or B+ Tree search responsive to  
2 a user query wherein said user query has a range for a first key value and a definite  
3 second key value is also specified in said user query, said program comprising;

4 a get next leaf page search routine having

5 a comparison element for examining a last record on a leaf  
6 page to determine if it has a first key value in said range and a second  
7 key value equal to said definite second key value specified in said user  
8 query,

9 a decision making element for determining which of two search  
10 routines should be used in fetching a next leaf page, said decision  
11 making element for generating a search using next sequential leaf  
12 page fetch locator signal resident in each leaf page if said first key  
13 value of said last record on a leaf page was in said range and said  
14 second key value of said last record on a leaf page was equal to said  
15 definite second key value, else for generating a signal value indicating  
16 a trapeze fetch will be used to find a next leaf page for record  
17 searching,

18 a B Tree search routine for searching root and index and data  
19 pages for next sequential first key values in said range when said  
20 signal value indicates a trapeze fetch will be used, and

21 a fetch routine for generating a page address fetch message  
22 sendable to an operating system to fetch said next page,

23 a record searching of a fetched page routine for sequentially searching  
24 records within a said fetched next page and for providing records matching each of  
25 said sequentially searched records from within said fetched next page to a query  
26 response generator routine, said search fetched page routine having a comparison  
27 routine for comparing first and second key values within each record to a current one  
28 of said first key values in said range and to said second key value.

**Claim 16:**

1 16. The search method program of Claim 15 further comprising a result report  
2 generator routine for generating a report including at least a predetermined number  
3 of records sent to said query response generator routine for display to a user.

**Claim 17:**

1 17. The search method program of Claim 15 further comprising a result report  
2 generator routine for generating a report including at least a predetermined number  
3 of records sent to said query response generator routine for use by a user.

**Claim 18:**

1 18. The search program of Claim 15 further comprising explanation generator  
2 routine for generating a report with data related to a number of times said B Tree  
3 search routine is employed during a said user query.

**Claim 19:**

1 19. The search program of Claim 15 further comprising an alternate switch-on-off-  
2 trapeze-fetch routine, wherein said alternate switch-on-off-trapeze-fetch routine has:

3 a recording routine for recording a positive swing value for each time a B Tree  
4 search is performed and a selected leaf page resulting from said search is not a  
5 same leaf page as a leaf page that would be selected by a sequential leaf search,  
6 and for recording a negative swing value each time a B Tree search is performed  
7 and a selected leaf page resulting from said search is a same leaf page as a leaf  
8 page that would be selected by a sequential leaf search;

9 a send disable-send enable signal routine for sending a disable B Tree  
10 search signal to said decision making element if said swing value reaches a  
11 predetermined positive value and for sending an enable B Tree search signal if said  
12 on-off value reaches a predetermined negative value,

13 and wherein said decision making element has a disable-enable trapeze fetch  
14 routine responsive to said disable B Tree search signal for performing a next  
15 sequential leaf fetch each time said decision making element receives said disable  
16 B Tree search signal, and responsive to said enable trapeze fetch signal each time  
17 said decision making element receives said enable B Tree search signal to enable  
18 said B Tree searching.

**Claim 20**

1 20. The search program of Claim 15 further comprising two additional routines, a  
2 first additional routine for turning off said second search when said second search is  
3 active and a second additional routine for turning on said second search when said  
4 second search is inactive, said first routine having a disable signaling means to



5 disable said decision-making element from selecting said trapeze fetch routine  
6 responsive to a disable signal from said disable signaling means, said disable  
7 signaling means for sending a disable signal if said B Tree did not skip any leaf  
8 pages when last performed, said second routine having an enable signaling means  
9 to enable said decision-making element to select said trapeze fetch if said selection  
10 is disabled, said enable signaling means for sending an enable signal when a  
11 predetermined number of pages that could have been skipped by said next  
12 sequential leaf fetch.

**Claim 21:**

1 21. The search program of Claim 20 wherein said predetermined number of  
2 pages that could have been skipped by said next sequential leaf fetch is between 1  
3 and 6.

**Claim 22:**

1 22. The search program of Claim 20 wherein said second routine further  
2 comprises first element for determining if a current first key value is found in any  
3 record on a leaf page, second element for determining if a new first key value in said  
4 first key value range is found in any record on a leaf page, and a counter, wherein a  
5 count is added if said first element finds no current first key value in a record on a  
6 leaf page and wherein the count is reset to its initial value if said second element  
7 finds a new first key value in said first key value range on a leaf page, and wherein  
8 when said counter reaches a predetermined value, said second routine enable  
9 signaling means is activated to send said enable signal.

**Claim 23:**

1 23. The search program of Claim 22 wherein said predetermined value is from  
2 2-5.

**Claim 24:**

- 1 24. The search program of Claim 15 wherein said search fetched page routine
- 2 searches all records in each said fetched leaf page and returns all records having
- 3 said second key value, regardless of whether a current first key value is found in
- 4 said records.